

Sign Structure Fastener Installation Guide

The following information is provided to assist SC staff in inspecting bolted connections for overhead sign structures. Refer to [BCM 55-1.03](#), *Steel Structures – General – Construction*, for additional guidance on bolted connections.

1 - Bolted Connections

Unless otherwise specified, all bolts and nuts must conform to the specifications of ASTM Designation A307. Also, unless otherwise specified, A307 bolts should be furnished with commercial quality washers, have hex heads and nuts, and should be “snug-tight”. A307 bolts should be of such length that they extend entirely through the nut (or nuts), but not more than 1/4 inch beyond. A307 bolts in shear must have not more than one thread within the grip.

Anchor bolts for sign foundations must conform to the specifications of ASTM Designation F1554 Grade 55, weldable steel. These bolts, washers, and nuts are to be galvanized as specified. Tighten anchor bolts to prevent removal by hand (snug-tight).

2 - High-Strength Fastener Assemblies

Where high-strength fastener assemblies are specified for overhead sign structures, the bolts, nuts, and washers must conform to the *Contract Specifications* Section 55, *Steel Structures*, unless they are shown to be snug-tight, in which case only Section 55-1.02D(1), *Steel Structures – General – Materials – General*, applies. High-strength fastener assemblies must comply with the specifications of ASTM F3125 A325. ASTM F3125 A325 requires that the bolt head be marked “A325”. Additionally, the bolt head may be marked with three radial lines spaced 120 degrees apart. High-strength ASTM A563 nuts will be marked with the number “2” or “2H”, by three equally spaced circumferential lines, or by the letters “D” or “DH”. These fastener assemblies are zinc-coated through mechanical deposition processes and typically have a lubricant applied to the nut when fully tensioned.

High-strength fastener assemblies are installed in accordance with the *Specification for Structural Joints Using High-Strength Bolts* of the [Research Council on Structural Connections](#) (RCSC) and require both rotational capacity and installation verification testing. They are tightened by any method using an alternating snugging and tensioning pattern to obtain the necessary tension. Do not allow the reuse of tensioned bolts.

As indicated in the *Contract Specifications* Section 55-1.02E(6)(c), *Steel Structures – General – Materials – Fabrication – Bolted Connections – Installation*, a (flat) hardened

washer must be installed under the turned element, regardless of the method used to tension the bolt, or the type of connection design. Lock washers are not an allowable substitute.

Assembly of high-strength bolted connections for sign structures may be performed with galvanizing or painting on the contact surfaces. The galvanized surface must be roughened by hand with a wire brush before assembly. The painted surfaces must comply with the RCSC specification for Class B coatings.

For overhead sign structures, measurement of bolt tension in field connections must be performed using approved direct tension indicators (DTI) furnished by the Contractor. One indicator must be furnished and installed with each bolt in accordance with the following:

- Washer-type tension indicators must be installed so that the lugs bear against the head of the fastener, which is not turned during tightening. After snugging up all bolts of the joint, tightening must progress from the most rigid part of the joint to the free edges. Bolts are tightened until at least 50% of the gaps on each indicator are between 0.000 and 0.005 inches. Reject assemblies where all the protrusions are completely crushed. The perimeter of DTI gaps needs to be sealed with caulking.

Pre-installation testing must be performed with the DTI using the procedures established by the RCSC.

The threads of nuts and bolts are to be adequately prepared to prevent “galling” and excessive friction losses. A307 and high-strength nuts and bolts are to have their threads properly tapped to accommodate galvanization. These fastener assemblies are mechanically galvanized and do not require that the nut threads be “chased.” The nuts are to receive a lubricant that is clean and dry to the touch. No attempt should be made to tension a high-strength fastener assembly that is not adequately lubricated. The bolt threads will usually gall and strip before the required bolt tension is reached. Nuts for HS bolts that are specified to be snug-tight must not be lubricated.

3 - Bridge-Mounted Signs

If mechanical anchorages are specified on the plans, check the special provisions for specific requirements. Do not allow the use of headed bolts inserted into wedge anchors. The use of drop-in (expansion) anchors and headed bolts may give questionable results. There is no way of confirming whether the drop-in anchor assembly has seated firmly in the concrete or if the headed bolt is cinched up against the mounting bracket.

Resin capsules are not to be used as stated on the Department's [Authorized Materials Lists](#); additional information may be found in the [Bridge Design Aids](#)¹ 5-81, *Anchorage to Concrete*, and its accompanying [Bridge Design Alert 5/11/20](#).

For additional information regarding expansion anchors, refer to [Attachment 1](#), *Expansion Anchorages*, of BCM 75, *Miscellaneous Metal*. A complete list of expansion anchors approved by the Transportation Laboratory is available on the Department's Authorized Material Lists.

¹ Caltrans internal use only